

In the Claims

1 1. (currently amended) An improvement in a compact electromagnetically pumped
2 multiwavelength photonic device, the improvement comprising a plurality of
3 nanocavities, each nanocavity defined in a photonic crystal in which each nanocavity
4 is lithographically formed to define a corresponding predetermined spectral response
5 of each nanocavity, said plurality of nanocavities forming a patterned array of
6 nanocavities.

1 2. (currently amended) The improvement photonic device array of claim 1 where
2 said spectral response of each nanocavity is defined by the wavelength of the
3 electromagnetic wave which is supported in the photonic crystal by said
4 lithographically defined nanocavity.

1 3. (currently amended) The improvement photonic device array of claim 1 where
2 said spectral response of each nanocavity is defined by the polarization of the
3 electromagnetic wave which is supported by said lithographically defined nanocavity.

1 4. (currently amended) The improvement photonic device of claim 1 where said
2 spectral response of each nanocavity is defined by the polarization and wavelength
3 of the electromagnetic wave which is supported by said lithographically defined
4 nanocavity.

1 5. (currently amended) The improvement photonic device of claim 1 where the
2 photonic device comprises a laser and wherein said array of nanocavities is
3 employed in the laser.

1 6. (currently amended) The improvement photonic device of claim 1 where the
2 photonic device comprises a detector and wherein said array of nanocavities is
3 employed in the detector.

1 7. (currently amended) The improvement photonic device of claim 1 where the
2 photonic device comprises an optical gate and wherein said array of nanocavities is
3 employed in the all optical gate.

1 8. (currently amended) The improvement photonic device of claim 1 where the
2 photonic device comprises an all optical router and wherein said array of
3 nanocavities is employed in the all optical router.

1 9. (currently amended) The improvement photonic device of claim 1 where the
2 photonic device comprises a modulator and wherein said array of nanocavities is
3 employed in the modulator.

1 10. (currently amended) The improvement photonic device of claim 1
2 wherein an active quantum well is included in the photonic device and wherein said

3 photonic crystal in which the array of nanocavities are defined is formed in the active
4 quantum well.

1 11. (currently amended) The ~~improvement~~ photonic device of claim 1 where
2 the photonic device comprises a vertical cavity surface emitting laser and wherein
3 said array of nanocavities is employed in the vertical cavity surface emitting laser,
4 VCSEL.

1 12. (currently amended) The ~~improvement~~ photonic device of claim 11 wherein said
2 nanocavities each have a volume and wherein said volume of each of said
3 nanocavities is approximately a cubic half-wavelength ($\lambda^3/2$).

1 13. (currently amended) The ~~improvement~~ photonic device of claim 1 comprises an
2 array of lasers each including an array of nanocavities and where at least one
3 nanocavity-laser is used as a pump for an adjacent nanocavity-laser.

1 14. (currently amended) The ~~improvement~~ photonic device of claim 1 further
2 comprising a nonlinear optical material filling said holes in the photonic crystal in
3 which the array of nanocavities are defined.

1 15. (currently amended) The ~~improvement~~ photonic device of claim 14
2 wherein said photonic device with the array of nanocavities defined in the filled

3 photonic crystal comprises a tunable ~~nanocavity~~-laser, detector, router, gate or
4 spectrometer array.

1 16. (currently amended) The ~~improvement~~ photonic device of claim 14 further
2 comprising means for changing optical or electrical properties of said nonlinear
3 optical material in each of said ~~nanocavities~~.

1 17. (currently amended) The ~~improvement~~ photonic device of claim 1 where said
2 photonic crystal in which said array is defined comprises a Si-Ge material on a
3 silicon substrate disposed on an insulator.

1 18. (currently amended) The ~~improvement~~ photonic device of claim 17
2 further comprising a silicon slab waveguide or integrated circuit integrated with said
3 array of ~~nanocavities~~.

1 19. (currently amended) The ~~improvement~~ photonic device of claim 17 further
2 comprising a nonlinear optical material filling said photonic crystal and means for
3 changing optical or electrical properties of said nonlinear optical material
4 surrounding each of said ~~nanocavities~~.

1 20. (currently amended) The ~~improvement~~ photonic device of claim 1 further
2 comprising a waveguiding layer disposed adjacent to said array of ~~nanocavities~~, said

3 waveguiding layer being transparent to light from said array and critically coupled to
4 said nanocavities in said array.